

## 5-5 Use Inequalities in a Triangle

Definition of Inequality--  $a > b$  iff there is a positive number  $c$ , such that  $a = b + c$

ex

$$7 = 3 + 4$$

$$7 > 3$$

$$7 > 4$$

## Properties

Transitive

Addition/Subtraction

Multiplication/Division

Subst.

Ex:



$$LN = LM + MN$$

$$LN > LM$$

$$LN > MN$$

def of an ineq.

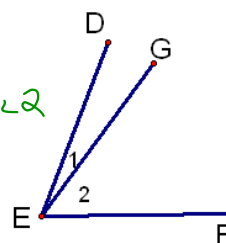
Ex:

$$m\angle DEF = m\angle 1 + m\angle 2$$

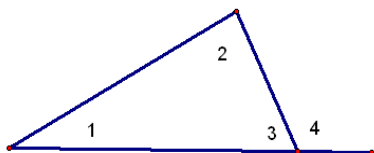
$$m\angle DEF > m\angle 1$$

$$m\angle DEF > m\angle 2$$

def of ineq



Ex:



$$m\angle 4 = m\angle 1 + m\angle 2$$

$$m\angle 4 > m\angle 1$$

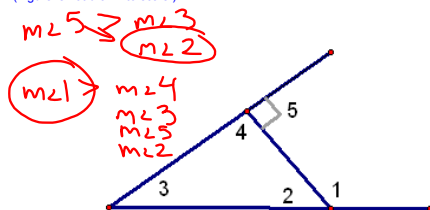
$$m\angle 4 > m\angle 2$$

Exterior Angle Inequality Theorem—The exterior angle of a triangle is greater than either of its corresponding remote interior angles

Ext.  $\angle$  Ineq. Thm

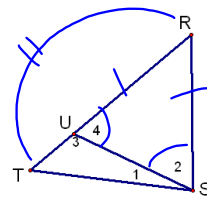
Which angle is the largest?

(Figure is not drawn to scale.)



Given:  $\triangle RST$   
 $RU = RS$   
 $RT > RS$

Prove:  $m\angle RST > m\angle T$



St.

- ①
- ②  $\angle 4 \cong \angle 2$
- ③  $m\angle 4 = m\angle 2$
- ④  $m\angle RST = m\angle 1 + m\angle 2$
- ⑤  $m\angle 4 > m\angle T$
- ⑥  $m\angle RST > m\angle 1$   
 $m\angle RST > m\angle 2$
- ⑦  $m\angle RST > m\angle 4$
- ⑧  $m\angle RST > m\angle T$

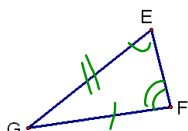
R.

- ① Given
- ② BAT
- ③ def of  $\cong$
- ④ AAP
- ⑤ Ext.  $\angle$  Ineq thm
- ⑥ def of  $>$
- ⑦ Subst.
- ⑧ Subs/Trans

Theorem 5.10--If one side of a triangle is longer than another side, then the angle opposite the longer side is larger than the angle opposite the shorter side.

$$G: GE > GF$$

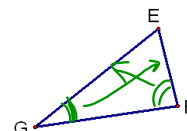
$$\text{Concl: } m\angle F > m\angle E$$



Theorem 5.11--If one angle of a triangle is larger than another angle, then the side opposite the larger angle is longer than the side opposite the smaller angle.

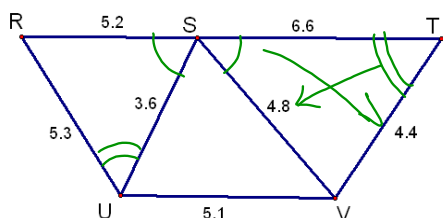
$$G: m\angle F > m\angle E$$

$$\text{Concl: } GE > GF$$



1. Which is greater,  $m\angle RSU$  or  $m\angle SUR$ ?

2. Which is greater,  $m\angle TSV$  or  $m\angle STV$ ?



Determine which angle has the greatest measure.

17.  $\angle 1, \angle 2, \angle 4$

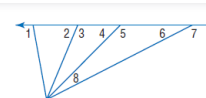
19.  $\angle 3, \angle 5, \angle 7$

21.  $\angle 5, \angle 7, \angle 8$

18.  $\angle 2, \angle 4, \angle 6$

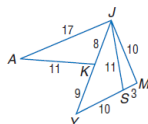
20.  $\angle 1, \angle 2, \angle 6$

22.  $\angle 2, \angle 6, \angle 8$



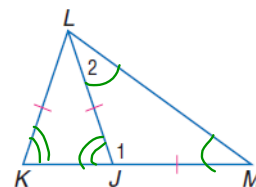
Determine the relationship between the measures of the given angles.

29.  $\angle KAJ$ ,  $\angle AJK$       30.  $\angle MJY$ ,  $\angle JYM$   
 31.  $\angle SMJ$ ,  $\angle MJS$       32.  $\angle AKJ$ ,  $\angle JAK$   
 33.  $\angle MYJ$ ,  $\angle JMY$       34.  $\angle JSY$ ,  $\angle JYS$



35. Given:  $\overline{JM} \cong \overline{JL}$   
 $\overline{JL} \cong \overline{KL}$

Prove:  $m\angle 1 > m\angle 2$

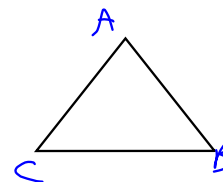


Pasta Challenge



Thm. 5.12--The triangle inequality theorem--the sum of the lengths of any 2 sides of a triangle is greater than the length of the 3rd side.

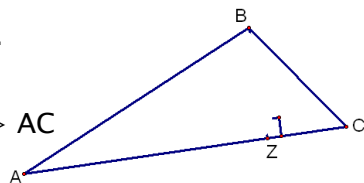
$$\begin{aligned} AB + BC &> AC \\ AB + AC &> BC \\ BC + AC &> AB \end{aligned}$$



Let's Prove it.

Given:  $\triangle ABC$

Prove:  $AB + BC > AC$



Do the lengths represent a triangle?

4, 5, 7    yes     $4+5 > 7 \checkmark$

13, 12, 20    yes

7, 14, 21    no     $7+14 \not> 21$

7, 7, 7    yes

8, 8, 19    no

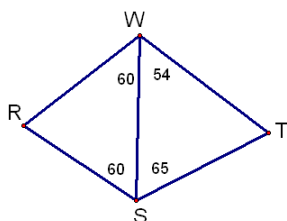
Two sides of a triangle are 6 and 11.  
What is the range of the 3rd side?

$$\begin{array}{r} 5 < x < 17 \\ \underline{+6} \quad \underline{+6} \\ 11 \quad 23 \end{array}$$

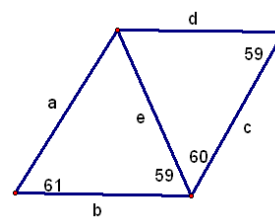
Two sides of a triangle are 12 and 18.  
What is the range of the 3rd side?

$$6 < x < 30$$

What is the longest segment?



What is the longest segment?



Describe the possible values for x.

$x > 4$   
 $x > \frac{8}{3}$   
 $x > -2$   
 $x > \frac{10}{3}$   
 $x < 18$   
 $x > \frac{6}{7}$   
 $\frac{10}{3} < x < 18$

$x+4$   
 $5x-8$   
 $3x+6$   
 $x > -2$   
 $x > \frac{8}{3}$   
 $x > \frac{10}{3}$   
 $x < 18$   
 $x > \frac{6}{7}$   
 $x > \frac{10}{3}$

HW p331-332

#s 6, 10-13, 16-19, 21-23, 30, 31, 33, 34